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RICE CULTIVATION IN ASIA

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243 THE terminology employed by writers discussing Asiatic rice agriculture has raised a problem: are the cultivated varieties of rice distinctly separable into one group that will grow under none but irrigated conditions, and another that demands moderate amounts of moisture but is successfully produced only by dry farming? The terms used in the literature frequently bear this implication. They include references to "wet" and "dry," "dryland," "lowland," "upland" and "mountain" rice. In anthropological studies whose purpose is merely descriptive this creates confusion. When extended to comparative studies and historical reconstructions, with the two methods of cultivation treated as distinct for the conclusions reached, it becomes necessary to examine the distinctions that might justify such use.

101 As early as 1820, John Crawfurd, writing his "History of the Indian Archi-
171 pelago," observed that rice is known as "padi . . . in all languages and dialects
243 from Madagascar to the Philippines."[1] He distinguished in Java a "marsh"
184 rice, sown in nurseries and transplanted to flooded fields, and a "mountain" or "dryland" rice, grown on arable uplands. These terms remain current. Lowie defines them thus:

243 The innumerable variations of the plant fall broadly into two categories, with corresponding techniques of husbandry. "Swamp" rice can be grown only in marshes or under irrigation. "Mountain" rice yields smaller crops, but can be grown anywhere with normal precipitation.[2]

Wilhelm Wagner[3] speaks in a similar sense of "den gewöhnliche Wasserreis" and "den sogenanten Bergreis," in his account of Chinese agriculture. C. Daryll Forde makes the same general differentiation of cultivated rices falling[4] into two groups due to the physical requirements of the plant. Wissler[5] mentions "The cultivated varieties known as 'hill,' 'upland,' or 'dryland' rice," in contradistinction to the "aquatic varieties." Keesing,[6] in one work on the Philippines, employs "wet" and "dry" rice; elsewhere[7] he speaks of "dry agriculture" in Indonesia, as distinguished from the practice of terracing with irrigation.

E. M. Loeb,[8] in his general ethnography of Sumatra, notes rice raised in both flooded and dry fields by the Bataks; in the Minangkabau, . . . "wet and dry rice fields are worked together by the men and women . . . ";[9] in Nias, . . . "both the wet and dry variety are grown . . . ";[10] in Atjeh, "Rice is of both the wet and dry variety. The wet rice fields, when not laid in swamps, are irrigated

[1] Crawfurd, 1820, Vol. I, p. 358. [2] Lowie, 1938, p. 294. [3] Wagner, 1926.
[4] Forde, 1934. [5] Wissler, 1946. [6] Keesing, 1937. [7] *Idem.*, 1934.
[8] Loeb, 1935. [9] *Ibid.*, p. 101. [10] *Ibid.*, p. 132.

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by rain water which is allowed to trickle down from dams . . . ";[11] among the Gajo and Alas, "Usually wet rice is cultivated, water being obtained from the rivers . . . ";[12] in southern Sumatra, the land is unsuitable for irrigation, so little "wet" rice is cultivated. In a historical note,[13] Loeb concludes that the Malaysians of Sumatra had learned to grow rice, ". . . at least the dry variety," before the Hindu occupancy. Cora Du Bois[14] believes that "dry" rice was the original staple of the Alorese. With reference to other descriptions, "dry" rice could be severally interpreted as the "dry-weather paddy" described by Scott[15] in Upper Burma; or as the "dry paddy" described in Mysore by Iyengar[16]—here referring to a district heavily watered by the monsoon rains, where artificial irrigation is not necessary. It could also be interpreted as the "dry-land" rice used by Fay-Cooper Cole.[17]

The Indian Department of Commercial Intelligence and Statistics[18] gives three classes of rice, according to their season of growth. The Philippine Department of Agriculture and Commerce[19] lumps all of the rice as "palay," taking the local variant of the widely used native term "paddy." From Oriental usage, Wickizer[20] defines "paddy" as an inclusive term for the growing plants, the harvested stalks, and the threshed, unhusked, grain. Keesing[21] gives "palay" as the native name for rice on the stalk. Some of the literature extends "paddy" to include irrigated rice fields; in this sense Keesing[22] uses it. Wickizer[23] adds that "wet paddy" and "dry paddy" are terms commonly used in Malaya to denote both the system of culture and the product.

The terms "upland" and "lowland" rice are even more current than "wet" and "dry." Verrier Elwin[24] uses them in describing the Baiga; R. F. Barton[25] for the Mountain Province of the Philippines, and Krieger[26] for the Philippines in general. Agronomists who use them include Camus[27] in the Philippines, and Jacobson[28] in the same area. Pelzer,[29] in his recent geographical study, considers them convenient, and Wickizer[30] likewise. Camus[31] adds "mountain" rice to "upland" rice, observing that the same varieties can be grown in both habitats, though some adapt best under the methods of cultivation obtaining in the mountains, others to those used in the uplands. His separation of "upland" and "lowland" rices is complicated by the fact that some of the Philippine "lowland" rices that are grown under irrigation are raised in non-irrigated nurseries or dry farmed previous to transplanting. "Dryland" nurseries for "wet

[11] *Ibid.*, p. 224. [12] *Ibid.*, p. 248. [13] *Ibid.*, p. 301. [14] DuBois, 1944.
[15] Scott, 1911. [16] Iyengar, 1927. [17] Cole, 1945.
[18] India Dept. of Commercial Intelligence and Statistics, 1940.
[19] Philippine Islands, Dept. of Agriculture and Commerce, 1935.
[20] Wickizer and Bennett, 1941. [21] Keesing, 1937. [22] *Ibid.*
[23] Wickizer and Bennett, 1941. [24] Elwin, 1939. [25] Barton, 1930.
[26] Krieger, 1942. [27] Camus, 1921. [28] Jacobson, 1915. [29] Pelzer, 1945.
[30] Wickizer and Bennett, 1941. [31] Camus, 1921.

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243 paddy" are also described in an official report[32] on the Pahang district in Malaya. Ethel Simkins,[33] in an article on the coastal plains of south India, designates "hill" rice, "upland" rice, and "lowland" rice. R. L. Pendleton[34] uses "upland" and "lowland" for Mindanao.

Detailed ethnographic accounts, especially those using native classifications of rice, multiply both the varieties and the methods of cultivation. Instances are Albert E. Jenks'[35] account of the Bontoc Igorot, Ralph Linton's[36] of the Tanala, and Nevill Parry's[37] of the Lakher. These enumerate the native names for the kinds of rice, the dates of sowing and harvest, the number of crops grown per year, the kinds of soil used and their preparation, with other details of cultivation. Parry[38] lists fourteen varieties distinguished by the Lakher and Lushai, with native descriptions of each, and of soil preferences. An elaborate but less satisfying description is Grierson's,[39] of Bihar. He classifies rice as sown broadcast or transplanted, lists over fifty varieties sown broadcast and over eighty transplanted, then proceeds to state that practice varies with the locality, a variety broadcast in one locale being sometimes treated by transplanting in another. Even if true for Bihar, this distinction would make nonsense elsewhere. Thus, in the Konkan, Ranade[40] describes seedlings grown for transplanting in nurseries, that are sown broadcast.

The agronomists have done their best to clear up the confusion.[41] First, as to kinds of rice: O. T. Faulkner,[42] in discussing West Africa, observes that the terms "hill" or "dryland" rice are deceptive, since all rice (*sic*) yields better in very wet soil. The latter is not a matter of general agreement, but Pelzer says:

> The remarkably large number of distinct varieties of cultivated rice . . . may be divided into two main classes: upland, or dry rice, and lowland, or wet rice. The division, based on the two main types of agronomic practice, is not a very sharp one.

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[32] Malaya, Dept. of Agriculture, 1939. [33] Simkins, 1933. [34] Pendleton, 1942.
[35] Jenks, 1905. [36] Linton, 1933. [37] Parry, 1933. [38] *Ibid.*
[39] Grierson, 1926. [40] Ranade, 1927.

[41] Jenkin W. Jones, Principal Agronomist in charge of Rice Investigations, U. S. Dept. of Agriculture, says the following in a letter to the writer:

"It is now generally understood that lowland ('wet') rice is grown on land submerged during a portion of the growing season. The land is submerged either by seasonal rainfall or by artificial irrigation. A large percentage of the world's rice crop—in Asia, Africa, Europe and the Western Hemisphere, is grown in this manner. In much of Asia the lowland (irrigated) rice is transplanted. Some of the lowland acreage also is transplanted in Africa, Europe, and the Western Hemisphere, but in these parts of the world much of it is sown in the same manner as other small grains, and irrigated. Rice grown on land not submerged, for any appreciable period during the growing season, that is, 'mountain,' 'dry,' 'dryland,' and 'hill,' and not provided with levees, dikes or terraced to hold water, now is generally known as upland rice. In my opinion . . . the terms used should be lowland (irrigated) or upland (non-irrigated) rice."

[42] Faulkner, 1935.

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Some upland varieties can be grown in flooded fields; however, it is said to be easier to grow dry rices in water than to grow wet rices on dry land.[42] 243

Wickizer[44] observes that "upland" rice, whatever its variety, is grown without irrigation, i.e., not in surface water; while "lowland" rice of all varieties is grown either under artificial irrigation or in natural swamps where there is standing water at appropriate seasons. Commonly, the varieties grown as "upland" rice are not the same as those grown as "lowland" rice, as they each adapt best to special conditions. A single variety can however often be grown under either system of cultivation.[45]

The kinds of rice set up by the agronomists are thus based upon the plant's adaptations. Hedayetullah[46] and Copeland[47] agree in stressing its tremendous adaptability. The latter emphasizes adaptation to varying amounts of water. He classifies as "upland" rice all varieties which are grown without artificial irrigation, but stipulates a considerable range of water tolerance between "lowland" rices. Wild varieties of rice are bearded, as are some cultivated ones, and these reportedly can stand flooding better and for longer periods of time than non-bearded varieties do. Some "lowland" rices grow even in salty water —these are grown in fields visited by the tides, in India, Siam and Annam. Copeland[48] reiterates Wickizer[49] to the effect that the "upland" and "lowland" varieties are:

> . . . groups not sharply separated in nature, being blended by many varieties which thrive with or without irrigation; but the division is practical by definition and conforms with agronomic practice.[50]

Wild rice, and many cultivated varieties, shed the seed upon maturity.[51]

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[42] Pelzer, 1945, p. 10.

[44] Wickizer and Bennett, 1941.

[45] Jenkin W. Jones states further:

"Lowland (irrigated) rice is more productive than upland (non-irrigated) rice, but land suitable for irrigation plus irrigation water—rainfall and irrigation systems—is limited in all parts of the world. Hence, in regions, particularly in Asia, having relatively high precipitation well distributed during the growing season, upland rice is grown. Upland rice cannot be grown except where the rainfall is rather heavy and well distributed. The varieties grown as upland rice yield more when grown under irrigation, but upland varieties are apparently somewhat more drought-resistant than are lowland varieties. Some lowland varieties, however, have a wide range of adaptation and will yield reasonably well when grown as upland rice."

[46] Hedayetullah, 1946.

[47] Copeland, 1924, p. 125.

[48] Copeland, 1924.

[49] Wickizer and Bennett, 1941.

[50] Copeland, 1924, p. 125.

[51] Jenkin Jones notes that:

"Red rice, a cultivated variety, is also the most serious weed in our Southern States. There is nothing unusual about rice shattering; most wild species have this characteristic."

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243 In this connection, Copeland[42] mentions wild rice as the most annoying weed in Philippine rice fields. M. Mène,[43] writing in regard to introducing "le riz sec de Chine" to the Midi, notes that it can resist violent winds without shedding its grain or collapsing. Further, the harvest need not be on a fixed date, but is amenable to the grower's convenience. Here, Hedayetullah[44] points to the duration of the maturation period as a foremost adaptation of the plant to environment. For the early rices, the date varies with the date of sowing; during their growth temperatures do not drop sharply. The transplanted winter rice, India's main crop, ripens when temperatures begin to drop and, despite variation in sowing dates, it matures on almost a fixed day. For cultivated varieties in general, Copeland[45] gives the range of the growth and maturation period as two[46] to ten months, remarking that it is an important varietal characteristic. He believes that there is probably an inherited ability to develop at a given rate, but since environmental conditions, such as seasonal fluctuations in temperature and precipitation, cause the period of development to vary also, the inherited limits are obscured.

The altitudinal limit of rice planting in the Philippines is 1500 feet; Wickizer[47] gives 7500 feet as the limit for "upland" rice in the tropics. Most varieties require four months of hot weather, at a temperature averaging 22°C., without sharp drops from day to night. "Upland" rice thrives at somewhat lower temperatures, "lowland" rice typically requiring two to three months at a temperature of 20°C. during growth.[48] Rice will not develop normally in shade, and most varieties cannot endure cold nights. "Upland" rice prefers light, loamy soils. Clay soils, which occur widely in the tropics, are well suited to irrigated rice culture, and where a substratum of hardpan occurs, downward seepage is prevented, which may be beneficial provided this is not too near to the surface of the soil. Coraline soils do not hold moisture long enough to raise a crop of "lowland" rice, and the limestones, as in eastern Java, are too porous to permit economical irrigation.

[42] Copeland, 1910.

[43] Mène, 1873.

[44] Hedayetullah, 1946.

[45] Copeland, 1924.

[46] Jenkin Jones comments:

"I have often heard of 60-day rice, but we have had over 8000 varieties of rice from various parts of the world, none of which have matured in 60 days under our conditions. . . . It has been our experience that in Asia at times the word 'plant' is used when 'transplanted' is the term meant; hence, if the rice matures in 60 days from the time it is transplanted, it was 30 to 60 days old when transplanted."

He refers to agricultural experiment stations in the United States, which can nowhere duplicate by any means the climatic, hence growing, conditions in Monsoon Asia.

[47] Wickizer and Bennett, 1941.

[48] Jenkin Jones would extend the estimated growing season of "lowland" rice to from three to six months, from his experience in the United States.

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Rice has food preferences. It does not require much nitrogen in order to survive, and it will grow in soils that are deficient in calcium and in phosphates.[59] Wells, Agcaoili and Feliciano[60] concluded that the chemical content of the grain is influenced by climatic conditions during growth; by type of soil, nature of fertilizers, and seasonal variation. Much[61] has been written about the improvement of the nutritional qualities of rice by modifying such factors as are controllable in cultivation. The plant apparently obtains only carbonaceous elements by photosynthesis from air, sunlight and water. Therefore, according to Albrecht,[62] the most important factors contributing to the proteinaceous and mineral content of the grain, and hence to its fertility, are soil composition and fertilizers. Transplanting and irrigation cannot supply elements lacking in the soil, though the algal film may make some oxygen available for irrigated rice.

The botanists have made only a beginning in tracing the origin of the cultivated varieties of rice. All ascribe it to one species—*Oryza sativa* Linnaeus. A few advance a polyphyletic origin. Not many surveys have been made in the Old World homes of wild rice. In the New World, the so-called wild rice gathered for food by some American Indians is not a true rice, but is a wild grass known to botanists as *Zizania aquatica*. Of the botanical investigations, Roschevicz'[63] studies are the most suggestive. Placing the origin of rice cultivation in Asia, he at the same time makes a case for some of the cultivated African rices having originated from wild African species—these akin to *Oryza sativa* L. *f. spontanea*. Further, he believes the latter to be a complex of small independent species. Its center of diversity is very possibly India, where

[59] Jones states as to food preferences of rice:

"Rice can, it is true, be grown on soils that are low in nitrogen, phosphorus, and potash, but the yields are certainly low also. Kelly has shown that with yields of 2400 to 3600 pounds of rice, 40 to 65 pounds of nitrogen, 26 to 41 pounds of phosphorus, and 60 to 113 pounds of potash per acre are removed. These amounts are not available in poor soils, and hence, yields as large as these are not obtained under such conditions. Rice responds to favorable conditions the same as do other crops . . . nitrogen . . . is most extensively applied to rice land where high yields are produced."

[60] Wells, Agcaoili and Feliciano, 1922.

[61] *See*: McCarrison, Robert, "Pathenogenesis of Deficiency Disease. XIV—On the Occurrence of Ophthalmia in Pigeons Fed Exclusively on Parboiled Rice and Its Prevention by the Addition of Soil to the Food," *Indian Journ. Medical Research*, 11 (2): 323–335, 1923; "The Relationship of Rice-beriberi in India," *Indian Med. Research Memoirs*, No. 2, 1924; and "Influence of Irrigation on the Nutritive Value of Rice," *Indian Journ. Med. Research*, 15: 915–920, 1928. Also: *see* Vedder, Edward B., and R. T. Feliciano, "An Investigation to Determine a Satisfactory Standard for Beriberi-Preventing Rices," *Philippine Journ. Science*, 35 (4): 351–389, 1928; Hermano, A. J., "The Nutritive Protein Value of Five Varieties of Rice," *Philippine Journ. Science*, 51: 567–572, 1933; Sreenivasan, A., "Nutritive Value of the Protein and Mineral Constituents of Rice Varieties," *Cereal Chemistry*, 19 (1): 36–47, 1942; Sreenivasan, A., and V. Sadasivan, "Nutritive Value of the Protein and Mineral Constituents of Dry and Wet Rices," *Cereal Chemistry*, 19 (1): 47–55, 1942.

[62] Albrecht, 1944.

[63] Roschevicz, 1931.

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243 he maintains that conditions favor mass mutation, and where he believes that such mutations have been utilized by rice growers since ancient times.[64] At any rate, and most likely in Africa, a number of the cultivated varieties have possibly originated from wild species such as *O. breviligulata*, *O. glaberrima*, and *O. officinalis*, which are related to *O. sativa* L. *f. spontanea*. The small-grained rices "very probably have taken rise from *Oryza minuta* Presl."[65] At least some of the multitudinous cultivated varieties could stem from the hybridization of these species with cultivated rices, the majority of which do owe their origin to *O. sativa* L. *f. spontanea*. The latter is referred to by Roschevicz[66] as a wild species; much of the literature does not specify it as wild, but lumps all cultivated rice as *O. sativa* L. Roschevicz[67] concludes:

> The botanic-morphological and the botanic-geographical methods of investigation applied to the material available to us, lead us to the following conclusions: (1) our cultivated rice belongs to section *Sativa* Roschev., having for its center of origin tropical Africa; (2) by far not all the cultivated rices have originated from *Oryza sativa* L. *f. spontanea;* many of them have their origin from species akin to *Oryza sativa* L., as *O. breviligulata* A. Cheval. et Roehr., *O. glaberrima* Stend., *O. minuta* Presl., *O. officinalis* Wall., etc., either by way of being introduced into cultivation along with *O. sativa* L., or by way of hybridization with the latter; (3) the great varietal diversity of cultivated rice in India and Indo-China may be explained not only by the ancientness of rice cultivation in these countries, but also by the fact that wild rice *Oryza sativa* L. *f. spontanea* has found there suitable conditions for the production of a considerable number of mutants (which did not take place in Africa) and that these mutants have been introduced into cultivation.
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> The Asiatic origin of rice cultivation is equally confirmed by the multifariousness of the varietal material which in China, Indo-China and India, and in general the whole of south-eastern Asia, is immensely rich in varieties and races, while the number of varieties and races known for Africa is inconsiderable . . . that the cultivation of rice as a world crop is due to China or to Indo-China, does not mean that rice did not thrive somewhere in the heart of central Africa, whose ancient history has remained a mystery to us, without having become known to ancient Egypt . . . as we know that rice was cultivated in Africa from the most ancient times, which is confirmed by the

[64] Jenkin Jones says concerning mutations:

"Mutations in rice probably occur much more frequently than was formerly supposed. . . . Most mutations in rice are recessive to normal. . . . on the basis of my observations over the past few years, mutations in rice, at least in this country, occur rather frequently.

"The rate of mutation no doubt depends upon the environment and the varieties of material grown. This also is true with respect to the extent of natural crossing between varieties, which also is more common than was formerly expected. These two factors, mutation and natural crossing, have no doubt been very active in the origin of the numerous varieties of rice present in Asia. . . . I am certain that the plant produces a greater number of varieties under domestication than in the wild."

[65] Roschevicz, p. 123.

[66] *Ibid.*

[67] *Ibid.*, pp. 123 ff.

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fact that Africa, as we have seen above, possesses varieties of its own, grown from local wild rices, the question where wild rice was first introduced into cultivation remains unsolved.

Though there are many more recent discussions than that of the Russian botanist, none consulted takes in as wide a range of material with comparable care. It is interesting to note that Roschevicz,[68] at least in the English summary of his text, makes no point of the physiological adaptations that lead agronomists to distinguish "wet" or "lowland," and "dry" or "upland," and deep-water rices. Parnell,[69] with the Indian botanists Ayyangar and Ramiah, remarks the existence of probably several thousand varieties of rice in India, and finds that the characteristics in which they differ are extremely varied, some being morphological and others physiological. Cross-fertilization would account for some of this great number of varieties. Burkhill is cited by Pelzer[70] as giving a polyphyletic origin for cultivated rice; *O. fatua* Koen. and *O. minuta* Presl. probably ancestors of *O. sativa* L.

Disregarding its botanical identity, the literature persists in classifying rice according to the methods employed in its cultivation. As to the "dry" or "upland" rice, the wide practice of shifting cultivation in conjunction with the cutting and burning of forest jungle or brush previous to cultivation may have helped to obscure the variant methods employed. This general practice, under such blanket designations as "jhum" (India), or "the milpa system" (Middle America), is used and abused in regard to its own variations, as well as in loose descriptions of the methods of rice cultivation. In Korea, where the technique has great antiquity, the Chinese refer to it as "fire field" agriculture. Common in southeast Asia, its historical connection with the development of rice cultivation has interested others than anthropologists. Pelzer[71] treats it elaborately, and semi-popular works like Bruno Lasker's[72] make the anthropologist desire a more careful understanding of the whole problem. Here, shifting cultivation is pertinent only insofar as it is one of the techniques employed in rice cultivation.

Chinese methods of rice cultivation were first widely discussed by French agronomists, whose practical interests led them there a hundred years ago. They also used the terms "wet" and "dry" rice. They were interested in introducing new varieties into the Midi, and for over forty years the Bulletin de la Société Zoologique d'Acclimatisation buzzed with discussions of "le riz sec de Chine." Notable among these is the account by E. H. de Méritens,[73] who

[68] Roschevicz, 1931.
[69] Parnell, Ayyangar, and Ramiah, 1917–1922.
[70] Pelzer, 1945.
[71] *Ibid.*
[72] Lasker, 1944.
[73] De Méritens, 1855.

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243 translated sections of a Chinese encyclopedia of agriculture, the Shou-shih T'ung-Kao, a work completed in 1742, and based on the H'su-Kuang-chi, which was compiled from original manuscripts and edited by one Ch'ên Tzu-lüng, on imperial orders. M. de Méritens,[74] writing in 1855, credits Leon d'Hervey Saint-Denys with the first interest in "le riz sec" among his countrymen. Baron d'Hervey Saint-Denys, in 1850, published "Recherches sur l'agriculture et l'horticulture des Chinois." As early as 1842, however, S. Julien[75] in a communication addressed to l'Académie des Sciences described "le riz que se culture à sec dans la Mongolie," and referred to the same Chinese source used by de Méritens.[76] The Shou-shih T'ung-Kao gives a classification based not only on methods of cultivation, but on the period required for the maturation of rice varieties. It accounts for two main groups of rice cultivated in China besides "le riz aquatique."

TABLE I. CHINESE VARIETIES, ACCORDING TO THE SHOU-SHIH T'UNG-KAO

Variety	*Date Sown*	*Date Harvested*
I. Sien-tao, or early rice, including:		
1. Lou-che-ji-tao, or 60-day rice[77]	April 5	June 5
2. Pe-ji-tao, or 100-day rice	April 5	July 5
3. Ta-sien, a large-grained variety	May 5	Early September
4. Siao-sien, a small-grained variety	April 5	August 5
II. Kang-tao, or late rice, including:		
1. Hanno		
2. A two-crop variety:—		
Crop one	March 21 to April 5	Summer
Crop two	Fall	Winter

Besides Sien-tao and Kang-tao, there is Ho-tao, or "riz de feu," suggestive of the "fire fields," but according to the source it was so called in China from its origin in the southwestern mountains, where the climate is hot and where rice is grown under difficult conditions from a Chinese standpoint. Suggestively again, fire fields are found today in the southwest. Ho-tao is transplanted in

[74] *Ibid.*

[75] Julien, 1842.

[76] De Méritens, 1855.

[77] Jenkin Jones comments here: "Unless it refers to a period from the time of transplanting, it is probably like our Sixty-day or Kherson oats which mature in 90 to 100 days. . . . In this connection, too, some of the authors quoted may refer to Rattoon crops of rice, that is, a second crop from one planting as the result of tillering under favorable conditions following the harvest of the first crop. Rice of this nature can mature in 60 days."

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China now, but in olden times this was not done. It includes varieties that vary 243
in shape, color and size of grain, and in consistency. Some varieties are fragrant. In Fukien, a plant known as "riz de Cochinchine" is cultivated on the uplands; this Julien[78] considers the best of all of "le riz sec." For one variety he gives the period of growth and maturation as 50 days, others maturing in 60, 80, and 100 days, in the main being harvested in August and September. This corresponds with the time given for Sien-tao. Julien[79] describes another "dry" rice from Jehol, a sample of which he sent to Paris, informing l'Académie des Sciences that it requires neither natural nor artificial irrigation.

The Shou-shih T'ung-kao, and a Chinese agriculturist of note, one Si-Hien-Tchong, relate how the Emperor Chin-Tsoung (A.D. 996–1021), to alleviate famine in eastern and western Chekiang, ordered the purchase of 30,000 bushels of drought-resisting rice from Fukien, distributing it to the poor people to plant under the instruction of his inspector of transport for grains. Again in the Sung Dynasty, Kiang-Ngao, a subprefect in Jouou-Tcheou, sent to his native Kien-ngan for drought-resisting rice to relieve famines, and thus introduced it to the uplands of the north Chinese valleys. This rice was found to yield abundantly, by local standards at the time. According to the encyclopedia both Sien-tao and Kang-tao were introduced from Cochinchina. The two groups differ in certain physical properties: Sien-tao is the smaller, brighter grained, and is nonglutinous. Kang-tao is sometimes bearded, includes glutinous varieties, and is found in many colors of awn, while Sien-tao is either red or white.[80]

The Chinese method of cultivation for "dry" rice, as given in the source, is different from that used for the "wet" rice. For "dry" rice the nurseries are tilled once in preparation for the seed, which previous to sowing is soaked for one night in water to hasten germination. Seed is not sown broadcast, but in small holes, a few grains to each; wet ashes, the product of burned plants or rice straw, are spread over the whole area sown; the nurseries are weeded three times, and subsequent to each weeding liquid manure is scattered on them. By this time the blade is above ground, and grows with great strength and rapidity. "Le riz sec" is said to thrive equally well on the plains or in the mountains. De Méritens[81] gives another method for its cultivation. Before sowing, the soil is moistened and manured thickly, sometimes with oil cakes, sometimes with

[78] Julien, 1842.

[79] *Ibid.*

[80] Jenkin Jones states in regard to this: "There are two kinds of rice based upon the nature of the endosperm—nonglutinous, which is grown most extensively, and glutinous (waxy). Both may be bearded or beardless, early or late, of poor or good quality, and have red, purple, brown or white bran coats. Kang-tao apparently was a mixture of nonglutinous and glutinous types similar in appearance and color, for rice, like other plants, does not change from one form to another except through hybridization and mutation."

[81] De Méritens, 1855.

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243 leaves and the bark of trees, in addition to animal manures. For the preparation of hard soils brushwood may be gathered and burned, and then plowed under. The rice is transplanted when it is about 20 cm. high. The fields in which it is set out must not be inundated, nor too dry. For "le riz sec," as for "le riz aquatique," the soil is usually prepared in spring. M. de Méritens[82] notes the greater labor involved in transplanting the latter. He draws on d'Hervey Saint-Denys for his information here. The main fields, after tilling, are flooded to receive the transplanted seedlings. First the laborer and his oxen tread the submerged mud, puddling it to a depth of 15 to 20 cm. The plow is not used in this process. The field is then harrowed to level it, and flooded again. The rice is then transplanted from the nurseries to the inundated fields, its roots immediately covered with mud by the action of the water. The roots are planted in holes prepared after the field is flooded, and just when the plants are being set out in rows. It goes without saying that transplanting to unsubmerged fields is less work.

In contemporary accounts there is unanimity on the fact that most Chinese rice is transplanted,[83] but there is less detail as to varieties. Wagner[84] gives "den gewöhnliche Wasserreis," "den sogenanten Bergreis," and "den Klebreis" (glutinous), but fails to distinguish methods of cultivation. His "mountain" rice ripens in four months, and his "water" rice (irrigated) subdivides into early, medium and late varieties. John L. Buck[85] describing land utilization in China, gives regional differences in agricultural techniques. In the Yangtze region, the slopes are terraced above the flood plains. In the southwest, terraced fields occupy fifteen per cent of the area cultivated, and some of the Lolos and Miao grow rice on terraced land. Szechwan is a frostless area where a spring crop is grown in addition to the main one, and is the only part of China where the soil is rich enough not to need fertilizers, although they are used to some extent. In what Buck[86] designates as the "rice-tea" area, much of which is hilly, the bottom lands are planted in rice. R. H. Tawney[87] remarks the use of "water farming" in the Yangtze region, and in the south, where double cropping of rice is a regular practice, together with more intensive cultivation. George Cressey,[88] like Buck,[89] divides China into agricultural regions. He blames the poor soil and the limited supply of water for the scanty planting

[82] *Ibid.*

[83] *See*: Martin Yang, 1945, *A Chinese Village. Taitou, Shantung Province*, pp. 22–23. The rice is sown in small holes, after plowing; it is not transplanted or irrigated; in a considerable area around Taitou no rice is grown. Fertilizers are employed, including ashes mixed with dung.

[84] Wagner, 1926.

[85] Buck, 1937.

[86] *Ibid.*

[87] Tawney, 1932.

[88] Cressey, 1934.

[89] Buck, 1937.

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of rice in northern China, stating that it can be grown as far north as Vladivostok. He summarizes: 243

> The most conspicuous boundary is the northern limit of continuous rice cultivation, with its flooded fields, canals and water buffalo, near latitude 33° North . . . this line es midway between the Yangtze and Hwang rivers along the crest of the Tsingling in the west and near the Hwai River in the east. South China is a green, humid, subtropical riceland, while the north is a dry brown wheatland under the influence of the desert . . . Major contrasts appear between the wheat and rice provinces . . . .The growing season in north China is five to eight months, while in south China it is ten months to a year, so that double cropping is more widespread and the same land can support more people. Rainfall is over twice as heavy in the south. The gross area of the south is larger but the presence of extensive plains in the north gives it a greater cultivated area. Nevertheless, the higher productivity of the rice lands enables them to support nearly twice the total population of the wheat-producing section.[90]

The Yangtze Valley is subject to the hazards of over-flooding and droughts, but the rice crop usually stands to benefit by the three-month flood period. This region yields one rice crop annually.[91] Terraces occupy the south Yangtze hills. Two, and sometimes three crops of rice per year are grown in southern China, where the yield per acre is second—in Asia—only to that of Japan, and is three times that of all India or Java. The lower and central Yangtze and the western and southern area of China lead in rice production. In the Canton delta the first crop is set out in March and harvested in July; a second crop is then transplanted to the main fields to be harvested in November. In eastern Chekiang an early crop is harvested in July, a late crop in October. Terraced lands are cultivated mainly in Szechwan, especially on the slopes of its Red Basin. Agriculture is most intensive in southern China, where the double cropping of rice is the regular practice. On the southwest tableland, rice is the dominant summer crop; it is often dependent entirely on rain for its water supply, excepting in the mile-high plateau, where flooded fields prevail. A description of Yunnan, edited by H. T. Fei,[92] notes that the southwest tableland and the valleys are diverse in both crops and population; here begins the altitudinal stratification of peoples and cultures that is so very characteristic of Farther India. The Lolos adhere to maize as their staple, growing some rice on terraced land. The Chinese immigrants grow mostly rice. They prepare the land in April, and bring off the crop in autumn.

[90] Cressey, 1944, pp. 91–93.

[91] Jenkin Jones notes: "In much of the Yangtze Valley and from Central Japan to the southern part only one rice crop is grown a year but the land is double cropped, wheat, barley and vegetables often being the second crop. In this connection, N. Jasny, in his *Competition among Grains*, Stanford University, 1940, p. 7, explains: 'Where the cool season is too cold and/or too dry for rice, fall-sown wheat or barley is frequently rotated with it on the same land and in the same crop year'."

[92] Institute of Pacific Relations, 1943.

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243 These few surveys are fairly compatible with that of the Shou-shih T'ung-Kao. The practical universality of transplanting in China is worthy of a remark. It has been demonstrated by agronomists that transplanting increases the yield per plant and per acre.[83] The seedling develops new grain-bearing tillers when it is transplanted, so that even double transplanting[84] has been found rewarding.[85] It economizes seed: in China one acre of nursery seedlings plants from ten to twenty-five acres of rice; and it permits double cropping, the second rice crop getting its start in the nursery while the first crop of rice, or in some cases another plant, as wheat or barley, matures in the field.[86] Transplanting can mitigate the dangers of drought and flood in the main fields by delay until favorable conditions return. In India and in the Philippines the rice transplanted is sometimes raised in a dry-farmed nursery.

Tanaka and Yekoussima,[87] writing in 1867, describe "dry" rice grown in Japan. The plant needs a certain amount of water, but it is not grown on flooded fields. In Jeddo (Yeddo) it is planted in March and harvested in October or November, at the same time when the irrigated rice is taken off.

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[83] Jenkin Jones interpolates here: "This is true in some tests, not so in others. Transplanting does save seed, irrigation water, makes the crop easier to fertilize and weed, and to double crop. These and not increased yields account for the practice in Central Japan and the Yangtze Valley."

[84] Hedayetullah, 1943.

[85] Jones says, to the contrary: "Tillering is associated with the variety, the conditions under which the rice is grown, spacing, number of plants per hole, climatic conditions and other factors, and if rice is transplanted rather close together you get essentially the same amount of tillering as if you had sown directly at the same spacing. That transplanting does not necessarily result in high yields is evident from the fact that much of the rice crop is transplanted in the Philippine Islands, Indo-China, Siam, Burma, and India, but the average yields in these countries are relatively low, ranging from 22 to 36 bushels per acre in the pre-war period; whereas, in California, Italy, Egypt, Spain, yields often range from 60 to 75 or 80 bushels per acre without transplanting."

[86] F. H. King, *Farmers of Forty Centuries*, Madison, Wis., 1911, includes increased yields in the benefits due to transplanting, to wit, p. 284: "Extensive as is the acreage of irrigated rice in China, Korea and Japan, nearly every spear is transplanted; the largest and best crop possible, rather than the least labor and trouble, as is so often the case with us, determining their methods and practices." *Ibid.*, pp. 288–289: "More than a month is saved for maturing and harvesting winter and early spring crops, or in fitting the fields for rice, by this planting in nursery beds. The irrigation period for most of the land is cut short a like amount, saving in both water and time. It is cheaper and easier to highly fertilize and prepare a small area for the nursery, while at the same time much stronger and more uniform plants are secured than would be possible by sowing in the field. The labor of weeding and caring for the plants in the nursery is far less than would be required in the field. It would be practically impossible to fit the entire rice areas as early in the season as the nursery beds are fitted, for the green manure is not yet grown and time is required for composting and for decaying, if plowed under directly. The rice plants in the nursery are carried to a stage where they are strong feeders and when set into the newly prepared, fertilized clean soil of the field they are ready to feed strongly, under these most favorable conditions. Both time and strength of plant are thus gained . . . the best possible practices under their condition of small holdings and dense population."

[87] Tanaka and Yekoussima, 1867.

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Remote from the main rice fields, it is grown on hill slopes where, when the summer is very hot, the Japanese have means to irrigate it. Before it is planted the ground is enriched with night soil. The seed is prepared by soaking for three days in water and then exposing to the sun. When sown it is mixed with ash and powdered fish refuse and scattered in furrows. It is subsequently weeded and cultivated. Transplanting is not mentioned in connection with this crop.

R. B. Hall[98] assigns only local importance to "upland" rice in Japan, where it now occupies in all 206,500 cho. In order of importance, the main producing areas are: the diluvial terraces of Kwanto, the dry central part of the Taiwan plain, and the ash plateau of southern Kyushu. A little is grown in Ou, the northernmost district of Old Japan, where the growing season is short and the climate relatively cold. The diluvial terraces of Kwanto have a " . . . cool, moist sprouting season and . . . a hot, dry ripening period."[99] In Hokkaido the growing season is short, "upland" rice is not cultivated, but quick-maturing "lowland" varieties have been established. Rice cultivation is only a recent development on the island, and the northern limit is set by a 90-day growing season. No altitudinal limit is mentioned for the Japanese islands. In Tokai, the East Sea district, there is " . . . irrigated rice on the delta plains and specialized dry land production on the terraces. . . . "[100] A variety known as "Izumo" is grown in San-in and along the Sea of Japan coast, a relatively cool region with a short growing season, where there is little level or arable land; we are left in doubt as to whether this is an "upland" variety of rice. Double cropping of rice, wheat, barley, and other crops is practiced in northern Kyushu (Kita), in southern Taiwan, and in the Nanki, Setouchi, and Tokai districts of Old Japan. The Hokuroku district, situated in the west central plains south of Ou, embraces " . . . the most specialized paddy areas in Japan."[101] The Kwanto plain produces almost as much "paddy" as Hokuroku and more than half of the "upland" rice crop of Japan. In the Imperial district of Kinai, the " . . . alluvial basin floors constitute vast paddy fields, and the average yield is the highest in Japan."[102] In Kinai a few terraces are cultivated.

In Korea, half the rice grown is dependent on rain for its water supply. In the north the growing season lasts only 100 days, the terrain is rugged, and "lowland" rice occupies a little over one tenth of the farm land. The northeastern people, who are shifting cultivators, grow no rice at all, while in the northwestern section there is " . . . a relatively important production of 'dry'

[98] Hall, 1934, 1935.
[99] *Idem*, 1935, p. 133.
[100] *Idem*, 1934, p. 339.
[101] *Ibid.*, p. 327.
[102] *Ibid.*, p. 336.

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243 rice."[103] As in his description of Japan, Hall[104] omits any mention of transplanting, though double cropping may be taken to infer it. He takes the southern boundary of central Korea as the line separating modernized (Japanese) rice cultivation and double cropping from simpler methods employed with single cropping in the north. In southern Korea the growing season lasts 150 days, and a higher proportion of rice fields is irrigated than elsewhere.

The Malay Peninsula presents a wide variety of agricultural methods. Here the "wet" system obtains for ninety per cent of the rice fields:

> But there are variations of both these main systems to suit local conditions: wet systems involving considerable preliminary cultivation as opposed to systems where cultivation is practically impossible owing to the soft nature of the land; dry systems which include both ploughing and raking, and a dry system which merely entails the clearing and burning the jungle in preparation for the crop.
>
> In the cultivation of "wet" padi the general procedure (of course with local variants) is to plough or dig the land once or twice, and rake or smooth it with a roller. The seed is planted in a nursery and is ready for transplanting in the field after 40 days. The seedlings are planted three or more per hill, about one foot apart. After cultivation consists of weeding.
>
> In dry padi cultivation the land is sometimes ploughed twice, raked and the seed sown by hand or drilled; or seed planted in clumps about a foot apart, or in hill cultivation, virgin land is cleared, burned, and the seed broadcast.
>
> Generally speaking, manuring is not a common practice in padi cultivation. In Kedah and Perlis, where bat guano is easily procured, the land is periodically manured. In Kelantan a system exists in which each plant, after transplanting, receives a small application of burnt mixture of cowdung and earth, coconut and arecanut leaves. In parts of Perak and in Province Wellesley and Malacca, the seedlings are steeped in a mixture of mud, phosphate and ashes immediately after removal from the nursery.[105]

In the Krian district of the Malay Peninsula, a floating seedbed is used. Weeds are cut, plastered together with clay, and piled in a long strip, to float as a platform on the surface of a flooded field, the top staying two inches above the water level. A thin layer of mud is applied to sow the seed in. The plot rises and falls with the water in the field, keeping the seedlings above water while their roots develop in the submerged layers. The seed is germinated prior to sowing by three days' soaking in water, and two more days in a moist condition. The germinated seed is broadcast on the nursery and a layer of leaves is put over it for ten days to protect it from the sun and from birds. In two weeks the plants are six to eight inches high. A similar nursery is used on the west coast of India. In the Malay Peninsula, the plants are set out first in clumps of 150 to 200, and partially submerged. At the second transplanting, ten days later, these clumps are broken into smaller ones that are placed in rows. Forty

[103] *Idem.*, 1935, p. 48.
[104] *Ibid.*
[105] Malaya, Dept. of Agriculture, 1939, p. 42.

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days later, at the third and final transplanting, the tops of the seedlings are cut back, and the roots are pruned and dibbled in. Two or three weedings take place after this. As soon as the plants flower, the water is gradually drained off the fields, to be gone when the grain has set and is ripening. The varieties that are planted in the best soil, in June, ripen in the short dry season early in the year, about February. The period of growth for irrigated rice may be said in general to last from seven to eight months. 243

In the district of Kelantan, "dry-land" nurseries are used for "wet padi." The site is plowed and harrowed twice, the seed broadcast thinly and harrowed in. Usually the single transplanting takes place forty days later, though adverse weather conditions may delay it as much as three months. The main fields cannot be cultivated until the July rains soften the soil. Preparation of the land and planting proceed from then until November, the low-lying areas being completed first, followed by the higher and drier areas. Plowing is not possible in all types of Kelantan soil. The transplanted rice crop is drained if there is an excess of rain. The crop is not weeded, but is manured as described above. In this district:

> Two distinct types of padi are cultivated, namely wet padi or padi chedongan, and dry padi, padi tugalan. This dry padi must not be confused with the dry or hill padi, padi huma, found in various parts of Malaya, as the methods of cultivation are distinct.[106]

Further:

> The land planted with dry padi falls into two groups, that habitually under the dry crop and that which may be utilized for either the wet or dry type. The latter forms but a small proportion of the whole and comprises the lower lying dry padi, or tugalan lands, the choice of wet or dry padi for any particular year usually depending on the inclination of the cultivator. Generally speaking, the fields are flat or slightly sloping and in the latter case wet padi is found at the bottom of the slope, dry padi land over the main area and the intermediate or alternating type mentioned above in a narrow strip between the two. . . .
>
> The soil throughout the dry padi lands is markedly homogeneous and . . . a heavy loam predominates.
>
> In view of the localized nature of the crop it is not surprising to find that there are only some twelve distinct varieties cultivated. The maturation periods of these varieties vary from 173 to 197 days and, though the majority can only be used as dry padi, there are some which can also be successfully planted on wet land.
>
> The success or otherwise of the dry padi crop is dependent on a favorable monsoon. Dry padi calls for an amount of labor and care which is greatly in excess of that required to produce a crop of the wet type.[107]

In Kelantan the dry season lasts from the middle of February until the end of May. After the early showers in July and August, the "dry padi" land

[106] *Ibid.*, pp. 48, 49.
[107] *Ibid.*

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243 is plowed and harrowed four times, and the seed dibbled in lines, before the monsoon rains come. Land must not be plowed or weeded when too wet, since packing or puddling this soil injures the plants.

A simpler method, like the one called "padi huma" in Trengganu, is used in farming "dry-land" rice in Province Wellesley North. It consists in cutting and burning the standing vegetation, followed sometimes by a light hand-digging after the April rains; the seed is dibbled into holes and covered, with no subsequent care. In Trengganu, four types of rice are distinguished locally

(1) Padi chedongan—"wet," transplanted rice.
(2) Padi taboran—rice broadcast on non-irrigated land.
(3) Padi tugalan—rice dibbled into dry land.
(4) Padi huma—rice dibbled in on burned off jungle land which is left to revert to jungle after one season's use.

The first is dependent chiefly on rain for irrigation. Type 3 is on the lines of the Kelantan "dry padi," described above. Type 2 is planted either because the owner knows no alternative method of cultivation, or because he has too much land to care for by the superior tugal method. Type 2 fields are plowed and harrowed three times; the seed is broadcast and covered with a harrow instead of dibbled in, and the crop is subsequently untended until harvest. The land is used and fallowed rotationally for type 2. Type 4 represents what some writers distinguish as true shifting cultivation: the fields are not re-used, new jungle being cleared and prepared annually.

In the Pahang district, after two or three crops of "dry padi," newly reclaimed land is often planted permanently with crops other than rice. Methods here are " . . . the most primitive of any of the four Federated Malay States." "Wet padi" is sown in nurseries in February and March, harvested in December and January. Planting periods vary with local seasonal differences. Pahang crops do not depend completely on rain water. Nurseries:

. . . for any types of "wet" cultivation are usually situated, on dry land . . . Secondary jungle is usually selected, felled and burnt shortly before sowing the seed. A few larger trees are usually left to afford light shade. The seed, previously soaked in water, is broadcast after the soil has been lightly cultivated, the area than raked to bury the seed. A small amount of weeding is done later if necessary and in the event of dry weather the beds may be watered. . . . The seedlings remain in the nursery for six to seven weeks, or much longer if weather is unsuitable for transplanting.[108]

"Wet padi" land in Pahang is locally differentiated as: (1) Paya, or natural swamp, subdivided into that which is at least partially fed by a stream, and that fed by rains alone; (2) Paya sawah, or artificially irrigated, often flat land, not always swampy; it may include terraced land, and most of it is provided with some form of water supply. Three methods are given for cultivating these two types of "wet padi" land. One involves transplanting, and is like Type 1

[108] *Ibid.*, p. 56.

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above in Trengganu. The standing grass is cut and left to rot. The soil may be worked by hand, or plowed. Sometimes " . . . buffaloes are employed to trample the grass on the paya and puddle the soil."[109] A second method includes presoaking the seed for two nights. The land is prepared as above, and the seed broadcast. A third method is attributed to the Sakai, many of whom live upstream on the main rivers. Virgin or secondary jungle is cut and burned in the dry season, the land then cultivated for two or three years successively. The moist seed is sown broadcast on the semi-wet swamp land (paya), after the rains begin. Crops receive no further care.

In areas marginal to mainland Asia, the evidence is that practice runs as wide a gamut as in the Malay Peninsula. For Madagascar we have Linton's[110] account. Mainland Africa, though having both "wet" and "dry" farming of rice, is not considered here. Going from Madagascar to the Philippines,[111] the Indonesians are found farming rice by both the "wet" and "dry" systems. The Philippines, best known for their elaborate terraced areas, include tribes that farm dry only with shifting cultivation, tribes that use both this and terracing with irrigation, and tribes that irrigate without terraces. In Java[112] and in Madura "upland" rice is grown on non-irrigated terraced land, besides the "wet" rice of the terraced and dyked flat lands. Shifting cultivation and dry farming obtain in the Lesser Soendas. Celebes farms rice by both irrigated and non-irrigated methods. So does Borneo:[113] the Dusuns and Muruts irrigate, the Dyaks elsewhere usually plant with the seasonal rhythms of the monsoons and rely on rain water.

Farther India presents varied environmental conditions; thus it is not surprising to find Estèbe[114] describing for Tonkin, Annam, Cambodia and Cochinchina these diverse groups of rice:

TABLE II. FARTHER INDIAN VARIETIES, AFTER ESTÈBE

Variety and Method of Cultivation	*Date Sown*	*Date Harvested*
1. Early rice. Transplanted once, in July, it matures in four to five months. It is cultivated on small fields for home use. It is hard to harvest because the rains come when it is ripe.	April	October

[109] *Ibid.*, p. 57.

[110] Linton, 1933.

[111] *See:* Barton, 1930; Christie, 1909; Cole, 1922; Garvan, 1941; Jenks, 1905; Pendleton, 1942; and Pelzer, 1945.

[112] *See:* Cole, 1945; Koch, 1930; Pelzer, 1945; Van Eerde, 1937; Van Valkenburg, 1935; and Wickizer and Bennett, 1941.

[113] *See:* Elshout, 1926; Hose and McDougall, 1912; and Rutter, 1929.

[114] Estèbe, 1934.

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2. Midseason rice ("Riz de demisaison"). It takes six months to mature. Grown on high and intermediate fields—high ones depend on rains. Highland varieties are grown much in north and east of Cochinchina, and on high fields in Cambodia during the rainy season.	June to July	December to January
3. Main crop ("Riz de saison"). Some varieties are transplanted once, some twice. It takes seven to eight months to mature. Grown on flooded and the richest alluvial soils; main crop on low fields of deltas and coast—some varieties are salt-tolerant, tides visit twice a day. Some 700 varieties grown in Indochina. Manures are much used. Rain-fed varieties are grown on high fields.	June to July	January to February
4. Twice-transplanted rice. Matures in nine months. Transplanted first in August, and again in October–November.	June to July	February to March
5. Floating rice.[113] Not transplanted. Grown in lake and delta regions, especially in Cambodia and Cochinchina. The seed is broadcast before the rains, the field cultivated once. Keeps on growing after floods, in depths *c.* three meters. When floods subside, the plants collapse, develop new roots and raise themselves, then flower and mature rapidly.	End of April	December to January
6. Post-flood rice. A secondary crop. Transplanted from highland nurseries to the banks of streams after the floods subside. Flowers in February–March, then matures rapidly. Sown on less productive lands after their main crop is off. It is being replaced with floating rice.	October to November	March to April
7. Two-crop rice:		
Crop one	May	October
Crop two	End of June	—
Crop two is transplanted in October to fields just harvested. Two-crop varieties are rare; they are grown in the Tonkin delta, and in Annam and Cochinchina. Some, on the coast, are salt-resistant.		

[113] Jenkin W. Jones comments: "Some varieties or types of rice are restricted to certain areas, including the so-called 'floating rice,' because of environmental conditions. The outstanding characteristic of floating rices is that they are able to grow rapidly as the water level rises, and hence, to survive. As a group, floating rices are relatively unimportant except in limited areas where, owing to floods, the usual types cannot be grown."

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Most of the rice is intermediate in its water requirement between the floating rice and the "riz de terrains sec," but does require a plentiful supply. Here, as in China, there are some varieties said to be of Siamese origin. Double cropping is rare in Cochinchina. 243

Estèbe[116] notes that "upland" varieties are grown to a great extent in northern and eastern Cochinchina, in the Mekong region, and in Cambodia on the high fields. In the Mekonga delta and elsewhere, such fields are dependent on rain for water supply, and it is sometimes retained in ditches in the Mekong region. These remarks are interesting in view of the Chinese account of rice introduced from Cochinchina. Chevey[117] gives an interesting account of the floods of the Tonle Sap, where floating, or deep-water, rice flourishes.

Van Valkenburg's[118] classification of rice in Farther India supplements Estèbe's,[119] but does not conflict. His includes: For Cambodia and Cochinchina, a floating rice (sometimes transplanted before the floods), and a dry season or post-flood rice; on the coasts of Annam, an "eighth month" rice and a "tenth month" rice; for the Tonkin delta, in addition to the two last named, a "twelfth month" rice, which includes "lowland" and "upland" varieties, and a "fifth month" rice, including the same, and also a two-crop rice. He allots the irrigated rices of Annam to the coastal plains and fertile valleys, the Tai in the upland valleys raising it also. Pierre Gourou's[120] survey of the Tonkin delta gives a "fifth month" rice, covered by deep water in summer, grown on the lowest lands, including salt-tolerant varieties, and harvested in June. He parallels Van Valkenburg[121] with an "eight month" rice that is harvested in September, and a ubiquitous "tenth month" rice, harvested in November. He mentions a "dry" rice harvested in September along with the "eighth month" rice. In the Tonkin delta, the two-crop rice is the most extensively cultivated. The second crop, in the nurseries during September, is weeded and irrigated while the first crop flowers and matures in the fields. There is also a "rice of three moons," that is reaped in August. The "fifth month," "tenth month," and two-crop rice are all intensively cultivated and grown in irrigated fields where the soil is periodically aerated and kept thoroughly manured.

Among the Karen[122] of Burma, the hill people plant, cut, and burn the upland fields; the lowlanders plow, harrow, puddle with buffalo, and plant nurseries, transplanting to flooded fields. Credner[123] makes a contrast in the methods of the Tai, who live where irrigation is possible, and those of their neighbors in the hills—Lolo, Lissu and Minchia, whose agriculture is "many-sided." Maitre[124] mentions "les hommes des rizieres," or of the "wet" rice fields, among the Moi; J. H. Hoffet[125] lists tribes of Moi who plant "rizieres" and those who plant "rai," or fired upland fields. Charles Robequain,[126] men-

[116] Estèbe, 1934. [117] Chevey, 1934. [118] Van Valkenburg, 1933.
[119] Estèbe, 1934. [120] Gourou, 1936. [121] Van Valkenburg, 1933.
[122] Marshall, 1922, pp. 67, 88, and pl. opp. p. 82. [123] Credner, 1935.
[124] Maitre, 1922. [125] Hoffett, 1933, pp. 8–29. [126] Robequain, 1939, p. 74.

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243 tioning unspecified back-country tribes in Indochina, makes the same distinction. Paul Palté[127] says that the hinterland Moi lack "les rizieres Annamites." Virginia Thompson[128] differentiates between the main crop and the fast-growing rice varieties in Siam. Zimmerman[129] details the local differences in practice among the Tai, and mentions several rices that mature in three, four, and five months in northeastern Siam, while in the south a few people grow "upland padi," but most rice is transplanted. Double cropping is rare here, and so are the refinements of southern Chinese rice culture, especially manuring.

In Assam, as wide a variation of practices exists as we noted for the Malay Peninsula. One nucleus of such variations clusters around a general pattern of shifting upland cultivation, here including terracing, and excluding the use of buffaloes and the plow. The wide altitudinal range of climate puts emphasis on suitability of the varieties planted to the particular locale. The Angami Nagas exemplify this situation. To cite Hutton:[130]

> The rice grown in wet fields is of several varieties, some sorts being suitable to low and hot situations, and others doing better in cold and high fields. The varieties differ also in the time taken to mature.

His "wet" rice refers to artificial irrigation. Though he lists native-named varieties, Hutton[131] employs "dry" and "wet," as:

> In some villages . . . terraces built for jhum . . . [are] almost as elaborate as those made for wet cultivation.

"Jhum" refers to the fire fields. The dry-farmed (non-irrigated) land gets good care. Seven of the native-named varieties are dry farmed, though one of these is grown also on irrigated terraced land. Mills,[132] in describing the Lhota, enumerates twelve native-named varieties of rice. In the Konyak villages, according to Fürer-Haimendorf,[133] the fields are non-irrigated; he makes no mention of rice varieties. Leaving the Nagas, we find the Lakher sowing their lightly hoed fields in April, the seed left exposed for rain to cover. They weed two or three times, and begin their harvest in October, pulling up the whole plants! Parry[134] gives fourteen native-named varieties with soil preferences, some maturing as late as December and January.

Cultivation in India may be equally diversified, but the material is more difficult of access. For Bengal, Hedayetullah[135] gives a five-fold classification, based upon methods of cultivation and season of growth. Thousands of varieties fall within these well-marked agricultural groups, which include some that are indistinguishable morphologically, but are physiologically distinct.

Sarat Chandra Roy[136] gives a good account of cultivation for the Orāons of Chota Nagpur. Other reports may be given: Grigson[137] describes the Maria

[127] Palté, 1906, p. 220. [128] Thompson, 1941, pp. 354–357. [129] Zimmerman, 1931.
[130] Hutton, 1921, p. 76. [131] *Ibid.* [132] Mills, 1922. [133] Fürer-Haimendorf, 1939.
[134] Parry, 1932. [135] Hedayetullah, 1946. [136] Roy, 1915. [137] Grigson, 1938.

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TABLE III. BENGAL VARIETIES, AFTER HEDAYETULLAH

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Variety and Method of Cultivation	Date Sown	Date Harvested
1. Early rice. Not transplanted. Grown on the highlands. Sown broadcast. Dependent on rain for water supply, and not ordinarily grown in flooded fields.	April to May	July to September
2. Winter rice. Transplanted into flooded fields in July and August. This constitutes the main crop.	June to July	October
3. Lowland rice. Not transplanted. Grown on low bhil lands. Sown before the heavy rains. Harvested in standing water, it grows in depths to six feet.	February to March	July to August
4. Floating rice. Not transplanted. Grown on the lowest floodlands. Sown broadcast before the rains. Collapses and reroots when the floods recede (as described by Estèbe in Farther India). Grows in depths to thirty feet, keeping the top above water.	February to March	November to July
5. Post-flood, or spring rice. Sown in nurseries and transplanted to river banks when the floods subside, or to lowlands that retain moisture throughout the winter. Sometimes irrigated.	October	March to April

Gonds of Bastar cultivating "light mountain rice," which produces three crops: early, main, and late. Some Marias are shifting cultivators, some have the beginnings of permanent cultivation with irrigation. The Hos in Kolhan[138] plow and transplant; when the land is hilly, they sometimes terrace it. Elwin[139] gives the Baiga sowing "upland" rice on fire fields, with hand tillage and water supplied by rains. Grierson[140] reports 60-day rice in Bihar, which is rain fed; other kinds are transplanted here, once or twice; these varieties mature at different periods from July through December. In the Konkan, on the west coast of India, Ranade[141] reports painstaking farming from the village of Roth Khurd. This is a fertile region where rain is abundant. Most of the rice grown here belongs to early varieties that are sown in May, after the rains set in, and are harvested in October. This rice is locally called "halvi." All of the fields depend on the monsoon rains for their water supply. The rice is transplanted. Nurseries are tilled by hand, and elaborately fertilized, first with a dressing of

[138] Majumdar, 1937. [139] Elwin, 1939. [140] Grierson, 1926. [141] Ranade, 1927.

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243 dung which is covered with grass and branches, then with fine dust, and on top of this with liquid manure. This preparation is made to ensure slow combustion. Then the whole field is fired in April or May, and is ready for sowing. The nursery is hastily plowed before the rains set in, and the seed is broadcast on it. If the monsoon rains hold off, the plot is irrigated. With regular rains, the plants are a foot high in two weeks. The main fields are prepared by several light plowings, and after they are flooded the seedlings are transplanted to them. The plant-tops reach above the water, and their roots become established in about two weeks. The fields are drained occasionally and weeded, and by harvest time are drained completely dry.

Ethel Simkins,[142] in a geographical survey of rice cultivation on the coastal plains of south India, finds that on the western coasts rice is grown the year around, as it is in Java. This does not hold true for the Madras coast, though the spring rains there do allow an early-season crop to be cultivated. The west coast, having dependable rains, needs little irrigation, whereas a large percentage of the east coast is irrigated. In the deltas, rice is grown on "wet paddy" land. Where the fields are irrigated, three crops a year are sometimes grown The main crop relies on rains.

> The "lowland" varieties are always transplanted; the "upland" rice is sown broadcast . . . [it is] a poor and coarse-grained variety, usually grown unirrigated.[143]

Wickizer[144] likewise remarks great variety in Indian agricultural practice.

In Asia the descriptions of rice cultivation have been over-simplified in the literature. Actually no sharp division in agronomic practices exists between the more and the less sophisticated peoples. The transitions between the methods employing irrigation and dry farming are too numerous to justify the continued use of "wet" and "dry." Classifications according to habitat, as "upland," "lowland," "mountain," and "swamp" are useless because the plant adapts so readily to varied environments. In comparative work and historical reconstructions such terms alone are inadequate.

COLUMBIA UNIVERSITY
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BIBLIOGRAPHY

113 ALBRECHT, WILLIAM A.
1944 Soil Fertility—Its Broader Implications. *American Fertilizer*, 101 (4): 7–9, 23–30.
BARTON, ROY FRANKLIN
1930 *The Half-Way Sun: Life among Headhunters of the Philippines.*

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[142] Simkins, 1933.
[143] *Ibid.*, p. 39.
[144] Wickizer and Bennett, 1941.

15: Adams E-4 (no date) 1948 AL1 Southeast Asia AL1

113

BUCK, JOHN L.
1937 *Land Utilization in China.*

CAMUS, J. S.
1921 Rice in the Philippines. *Philippine Islands Bureau of Agriculture Bulletin*, No. 37.

CHEVEY, P.
1934 The Great Lake of Cambodia, the Underlying Sources of Its Richness in Fish. *Pacific Science Congress, Proc.*, No. 5: 3809–3816.

CHRISTIE, EMERSON B.
1909 *The Subanuns of Sindangan Bay.* Philippine Bureau of Science Publ., Ethnol. Ser., Vol. 6, Pt. 1.

COLE, FAY COOPER
1913 *The Wild Tribes of Davao District, Mindanao.* Field Museum of Natural History, Anthrop. Ser., XII, No. 2.
1922 *The Tinguian.* Field Museum of Natural History, Anthrop. Ser., XIV. No. 2.
1945 *The Peoples of Malaysia.*

COPELAND, E. B.
1910 *Elements of Philippine Agriculture.*
1924 *Rice.*

CRAWFURD, JOHN
1820 *History of the Indian Archipelago.*

CREDNER, WILLIAM
1935 *Cultural and Geographical Observations Made in the Tali (Yunnan) Region, with Special Regard to the Nan-Chao Problem.*

CRESSEY, GEORGE B.
1934 Agricultural Regions of Asia. Part VI, China. *Economic Geography*, 10 (2): 109–142.

DU BOIS, CORA
1944 *The People of Alor.*

ELSHOUT, J. M.
1926 *De Kenjo-Dayaks uit het Apo-Kayan Gebied; bijdragen tot de kennis van centraal-Borneo.*

ELWIN, VERRIER
1939 *The Baiga.*

EERDE, J. C. VAN
1937 *De volken van Nederlandsch Indie.* Deel 1.

ESTÈBE, PAUL
1934 *Le Problème du Riz en Indochine.*

FAULKNER, O. T., and J. R. MACKIE
1933 *West African Agriculture.*

FORDE, C. DARYLL
1934 *Habitat, Economy and Society.*

FÜRER-HAIMENDORF, C. VON
1939 *The Naked Nagas.*

GARVAN, JOHN M.
1941 *The Manobos of Mindanao.* National Academy of Sciences, Memoirs, Vol. 23, No. 1.

GOUROU, PIERRE
1936 *Les Paysans du Delta Tonkinois.* L'École Française d'Extrême Orient, Publ. No. 27.

GRIERSON, GEORGE A.
1926 *Bihar Peasant Life.*

GRIGSON, W. V.
1938 *The Maria Gonds of Bastar.*

15:Adams E-4 (no date)1948 ALl Southeast Asia ALl

113 HALL, ROBERT BURNETT
1934, 1935 Agricultural Regions of Asia. Part VII, The Japanese Empire. *Economic Geography*, 10(4): 324–347; 11(1): 33–52; 11(2): 130–147.

KHDAYEKULLAH, S.
1943 Double Transplantation of Paddy and Its Effects on the Yield of Grain and Straw. *Science and Culture*, 8(7): 313–314.
1946 Improved Paddy in Bengal. *Science and Culture*, 11(10): 524–531.

HOFFET, J. H.
1933 Les Mois de la Chaine Anamitique entre Tourane et les Boloven. *Terre. Air. Mer.* 59: 1–43.

HOSE, CHARLES, and WILLIAM McDOUGALL
1912 *The Pagan Tribes of Borneo.* 2 vols.

HUTTON, J. H.
1921 *The Angami Nagas.*

INDIA. DEPARTMENT OF COMMERCIAL INTELLIGENCE AND STATISTICS
1940 *Estimates of Area and Yield of Principal Crops in India.*

INSTITUTE OF PACIFIC RELATIONS
1943 *Three Types of Rural Economy in Yunnan.* Edited by H. T. Fei.

IYENGAR, S. KESAVA
1927 *Studies in Indian Rural Economics.*

JACOBSON, HENRY O.
1915 *Rice in the Philippines.*

JENKS, ALBERT E.
1905 *The Bontoc Igorot.* U. S. Dept. of Interior, Ethnol. Survey No. 1.

JULIEN, S.
1842 *Économie Agricole. Riz que se cultive à sec dans la Mongolie.* Académie des Sciences. Comptes rendus, 14: 40–42.

KEESING, FELIX M.
1937 *The Philippines; a Nation in the Making.*

KEESING, FELIX M., and M. KEESING
1934 *Taming Philippine Headhunters.*

KOCH, L.
1930 Past, Present and Future in the Obtaining and Spreading of Superior Rice Varieties in the Dutch East Indies. *Fourth Pacific Science Congress, 1929. Proc.*, Vol. 4: 9–14.

KRIEGER, HERBERT W.
1942 *Peoples of the Philippines.* Smithsonian Institution.

KROEBER, A. L.
1928 *Peoples of the Philippines.* American Museum of Natural History, Handbook, Ser. 8.

LASKER, BRUNO
1944 *Peoples of Southeast Asia.*

LINTON, RALPH
1933 *The Tanala.*

LOEB, E. M.
1935 Sumatra, Its History and People. In: *Wiener Beiträge zur Kulturgeschichte und Linguistik*, Vol. 3, pp. 1–303.

LOWIE, R. H.
1938 Subsistence. In: *General Anthropology.* Edited by Franz Boas.

MAÎTRE, HENRI
1912 *Les Jungles Moi.*

15:Adams E-4 (no date)1948 ALl Southeast Asia ALl

113

MAJUMDAR, D. N.
1937 *A Tribe in Transition.*

MALAYA DEPARTMENT OF AGRICULTURE
1939 Padi Planting Methods in Malaya. *Malayan Agricultural Journal*, 27: 40–59.

MARSHALL, H. I.
1922 The Karen People of Burma. *Ohio State University Bulletin. Contributions in History and Political Science*, Vol. 26, No. 13.

MÉNÉ.
1873 Riz sec de Chine. *Société Zoologique d'Acclimatisation. Bulletin*, Ser. 2, 10: 161–162.

MÉRITENS, E. H. DE
1855 Mémoire sur le Riz Sec. Traduit de l'Encyclopédie Cheou-Chi-Tong-Kao, Livre 20. *Société Zoologique d'Acclimatisation. Bulletin*, Ser. I, Vol. 2: 275–289.

MILLER, EDWARD Y.
1905 *The Bataks of Palawan.* Philippine Islands, Dept. of Interior. Ethnol. Survey Publ., Vol. 2, Pt. 3.

MILLS, J. P.
1922 *The Lhota Nagas.*

PALTÉ, PAUL
1906 *Hinterland Moi.*

PARNELL, B. A., C. W. AYYANGAR, and K. RAMIAH
1917 The Inheritance of Characteristics in Rice. *India. Agric. Dept. Mem., Botanical Ser.*, Vol. 9, No. 2 and Vol. 11, No. 8.

PARRY, NEVILL E.
1932 *The Lakhers.*

PELZER, KARL
1945 *Pioneer Settlement in the Asiatic Tropics.* Amer. Geog. Soc., Special Publ. No. 29.

PENDLETON, R. L.
1942 Land Utilization and Agriculture of Mindanao, Philippine Islands. *Geographical Review*, 32(2): 180–210.

PHILIPPINE ISLANDS DEPT. OF AGRICULTURE AND COMMERCE
1935 Economic and Social Conditions of the Philippine Islands, 1935. *Spec. Supplement Philippine Review*, Vol. 2.

RANADE, V. G.
1927 *A Social and Economic Survey of a Konkan Village.*

ROBEQUAIN, CHARLES
1939 *L'Évolution économique de l'Indochine française.* Centre d'Études de Politique Étrangère. Travaux des Groupes d'Études. Publ. No. 13.

ROSCHEVICZ, R. J.
1931 Contribution to the Knowledge of Rice. *Bulletin of Applied Botony, Genetics, and Plant-Breeding*. Vol. 27, No. 4.

ROY, SARAT CHANDRA
1915 *The Orâons of Chota Nagpur.*

RUTTER, OWEN
1929 *The Pagans of North Borneo.*

SCOTT, J. GEORGE (SHWAY YOE)
1911 *Burma: a Handbook.*

SIKKINK, ETHEL
1933 The Coastal Plains of South India, Parts I and II. *Economic Geography*, 9(1): 19–50; 9(2): 136–159.

15:Adams E-4 (no date)1948 ALl Southeast Asia ALl

113 TANAKA and YEKOUSSIMA
1867 Notes sur le Riz Sec . . . du Japon. *Société Zoologique d'Acclimatation, Bulletin*, Ser. 2, Vol. 4: 339–342.

TAWNEY, R. H.
1932 *Land and Labor in China.*

THOMPSON, VIRGINIA
1941 *Thailand, the New Siam.*

VALKENBURG, SAMUEL VAN
1933 Agricultural Regions of Asia. Part III, Farther India. *Economic Geography*, 9(1): 2–18.
1933–1934 Agricultural Regions of Asia. Parts IV and V, India. *Ibid.*, 9(2): 1–135; 10(1): 15–34.
1935 Agricultural Regions of Asia. Part VIII, Malaysia. *Ibid.*, 11(3): 227–246; 11(4): 325–337.

WAGNER, WILHELM
1926 *Die Chinesische Landwirtschaft.*

WELLS, A. H., F. AGCAOILI, and R. T. FELICIANO
1922 Philippine Rice. *Philippine Journal of Science*, 20: 353–361.

WICKIZER, V. D., and M. K. BENNETT
1941 *The Rice Economy of Monsoon Asia.*

ZIMMERMAN, CARL C.
1931 *Siam: a Rural Economic Survey.*